

USGS National Hydrography Dataset Newsletter  
Vol. 14, No. 6, April 2015  
by Jeff Simley, USGS

## **The USGS Plans Hydrography for the Year Ahead**

The week of April 20<sup>th</sup> the USGS met to plan for the National Hydrography Dataset and Watershed Boundary Dataset in the next fiscal year starting this coming October. The USGS hydrography program has three main thrusts: The first is to steadily improve the NHD coverage for the country by improving the accuracy of the data. The second is to move the NHD to the “next generation”, which is to integrate the NHD with elevation data and enrich the value of hydrography in the form of the NHDPlus. The third is to improve the WBD in a continuous process of updating the data with new knowledge of the landscape.

Associated with these three main thrusts there is a lot of work that needs to be done to make hydrography work. To accomplish all of this the workload is organized into seven categories dealing with (1) the acquisition of data, (2) improving existing data, (3) the delivery of data and information, (4) linking data together, (5) improving the data model, (6) producing the high resolution NHDPlus, and (7) advancing the concepts of hydrography and elevation integration. The acquisition of data largely revolves around the stewardship of the data by a vast network of partners vested in applying the NHD to solve their water related issues. These issues primarily deal with water quality, but cover a broad range of topics. In some cases these efforts replace existing NHD with a new, more highly detailed representation of hydrography. Improving existing data involves the integrity of the data. The NHD and WBD have many attributes that make the data perform as a network and making this work requires continuous attention. The delivery of data and information is concerned with putting the NHD and WBD in the hands of users to enable them to put the datasets right to work. It also involves providing supporting information backing up the data. Linking data together is the process of taking the vast resources of water information and tying this to a geospatial platform so that it can be used in a spatial and network context. Improving the data model means organizing the NHD and WBD into a schema that makes it effective in a geographic information system. The goal is to take the vast complexities of the NHD and WBD and molding this into a straightforward form. Producing the high resolution NHDPlus is a matter of capitalizing on the success of the NHDPlus at 1:100,000-scale and making this happen at 1:24,000-scale and better. Advancing hydrography-elevation integration has a goal of making these two forms of the landscape work in unison and allowing one to inform the other.

## **Hydrography Seminar Series**

On April 9 about 150 people joined together for a webinar featuring Dr. William Samuels of Leidos speaking on the Incident Command Tool for water. This was the first in a series of webinars on hydrography to be presented by the USGS about once every six weeks. The series is designed to provide information about how the NHD, NHDPlus, and WBD work, and features speakers from a variety of disciplines on how the data is applied to solving problems in the management of water resources in the U.S. Dr. Samuels’ presentation covered the January 2014 Elk River chemical spill in West Virginia, specifically the use of the NHDPlus, real-time stream flow and velocity information from stream gages and models, and the Incident Command Tool for Drinking Water Protection application to limit effects of the spill on communities downstream.

The next seminar will feature Ed Clark of NOAA who will speak on the The National Flood Interoperability Experiment – Leveraging USGS Elevation and Hydrography Data to define a common framework for integrating water resources datasets. This will be held on May 21<sup>st</sup> at 2:00 PM Eastern

Time. Subscribers of the NHD Newsletter will receive an email with instructions on how to register for the event.

The National Flood Interoperability Experiment (NFIE) is a one-year collaboration, from September 2014 to August 2015, between the National Weather Service and its government partners, and the academic community and commercial partners, that is designed to demonstrate a transformational suite of science and services for the next generation of national flood hydrology and emergency response. Its intent is to better connect, in both directions, the flow of information among the federal, state and local entities responsible for measurement, forecasting and planning for floods, with the corresponding entities in the emergency response community. This experiment leverages new communications standards that simplify the exchange of water information among disparate producers and consumers, as well as integrating cutting edge hydrologic modeling and analysis techniques from the research community. With multiple federal agencies, and numerous academic institutions participating in the NFIE, the experiment requires a common framework for integrating information developed within newly develop hydrologic models and research effort with experimental and operational data services from federal agencies. This webinar will explore how organizers for the NFIE leveraged the National Hydrographic Dataset Plus Version 2 (NHDPlusV2) as the common hydrography model for conflating data during the experiment, and thus breaking down barriers new and exciting flood prediction and characterization services.

Ed Clark is the National Flash Flood Service Leader in the National Weather Service Headquarters Forecast Service Division.

#### **NHD Conflation Research** by Kevin McNinch, Ellen Finelli, and Greg Matthews

In the first half of federal fiscal year 2015, the USGS conducted research to evaluate NHD conflation processes and data maintenance workflows. The research team worked with the USGS business owners, NHD GeoConflation user community, the NHD Advisory Committee, and the NHD Management Team to confirm and refine NHD conflation requirements and propose options for future NHD conflation workflows. The USGS National Geospatial Program System Design Board (SDB) reviewed the team's findings and provided guidance on how to proceed with NHD conflation.

The SDB guidance on NHD Conflation is:

1. Continue to maintain and enhance the current iteration of the NHD GeoConflation Tool (released February 25th via the MyUSGS [GeoConflation Community](#))
2. Initiate research to investigate simpler NHD conflation workflows by developing a simpler data model or re-indexing events
3. Evaluate COTS software packages if the NHD conflation workflow changes

NGTOC has begun NHD conflation research Phase 2 for the second half of fiscal year 2015 to continue investigating the future of NHD conflation. This research will:

1. Work with USGS NGTOC Vector Desktop Tools application development team to support maintenance and prioritize enhancements to the current NHD GeoConflation Tool
2. Participate in the NHD Data Model Simplification Group [led by Al Rea] to investigate simplifying the NHD data model to allow for an easier NHD conflation workflow
3. Study and recommend potential workflow improvements to re-index NHD events
4. Study and recommend improvements to hydrographic event management (HEM) tool and process with regard to Event Synchronization
5. Finalize and document all user comments collected during Phase 1 NHD Conflation Research, a summary of major user comments were presented to the SDB

Though the research team is not actively seeking community comment, we are interested in hearing thoughts and ideas on the future of NHD conflation workflows. Please send any comments to [klmcninch@usgs.gov](mailto:klmcninch@usgs.gov)

USGS will continue to support the NHD GeoConflation Tool and the user community while research into other methods is ongoing. Please continue to provide any comments, issues, or proposed enhancements with current NHD GeoConflation Tools to the product owner: David Anderson ([danderson@usgs.gov](mailto:danderson@usgs.gov) or [nhd-gct@usgs.gov](mailto:nhd-gct@usgs.gov)). David is actively prioritizing a backlog of development issues. The next GCT Technical Exchange Meeting is scheduled for June 24th and the 4th Wednesday of each even month (see [Technical Exchange Meeting \(TEM\) Information](#) for more information and scheduling). Please be sure to attend. We are counting on your insight.

### **Proposal to Improve NHD Stream Classification in the Arid West by Keven Roth**

Are Nevada and New Mexico the wettest states in the country? To look at some maps one might think so. What these maps indicate is not that these states are wet, but that ephemeral streams dominate the landscape. Sorting out ephemeral and intermittent streams has been a long-standing challenge in the arid west.

Early USGS topo maps had two choices for stream classification, perennial and intermittent. In the mid-1960s, the realization that arid regions were different from the rest of the country prompted work to come up with a new symbol for “ephemeral” streams. A dotted brown line for ephemeral streams was implemented on a limited number of maps created in the mid-1970s for parts of six southwestern states. Maps that were created before this ephemeral symbol was implemented were never modified, and in the 1990’s the symbol was generally discontinued. The fundamental problem was not resolved.

The apparent wetness of Nevada and New Mexico was noted during the early stages of creating the NHD. This defied common logic, simple observation, and was not accurate. However, the development of the NHD was focused on creating a robust tool for the full United States, and there were no resources available to fine-tune stream classifications in one region of the country.

Recently, as part of a discussion on how to treat LiDAR-derived channels, the Nevada Department of Environmental Protection confirmed that most of their streams are ephemeral, which led to discussions on how to better identify ephemeral and intermittent streams. Traditionally, the USGS map-making process began with on-site information gathering. In the arid west, a significant aspect of that work was to collect place names from people in the area, and those names were overwhelmingly associated streams that had flow all year or at least part of the year. Water was a precious commodity, and the significance of fairly predictable flow led to the naming of those streams. Intermittent streams that might save your life or support your livestock were named; dry channels were not. This led to the hypothesis that “intermittent streams have names and ephemeral streams do not.”

This idea was tested using gaging station data, stream formation potential maps, orthoimages, reports written by federal and local organizations describing the flow regime in streams and NHDPlus EROM (enhanced run-off method) data. Sample NHD data for Nevada was modified based on the hypothesis and examples were discussed with NVDEP. Nevada found the “named=intermittent” approach practical and the results impressive. They also encouraged a regional approach, since the problem was shared with neighboring states.

Because of similar problems, and a belief that streams were not classified “correctly” in the NHD, the Bureau of Land Management launched a project in the Colorado Plateau (HU region 14) to “fix” the ephemeral streams. Region 14 includes most of western Colorado, eastern Utah and southwestern

Wyoming. The named approach was used as the first cut at the changes to be made, and modeling from elevation data and riparian data collected by BLM were used to refine the approach. NHDPlus EROM data was used to verify the changes.

With positive results and support from Regions 14 and 16, the NHD team began to look at the rest of the arid west. New Mexico, mostly in Region 13, was an obvious partner. The NHD steward in the New Mexico agreed that re-classification is important and that the named approach would be a straight-forward way to improve stream the data. In fact, work by the USFS in New Mexico anticipated our proposed approach. Several years ago, the USFS provided edits to NHD for the Gila National Forest in southwestern NM. Those edits corrected the issue with ephemeral streams, and those corrections correlate nicely with the use of names as indicators of intermittent streams. USFS data was field verified, and results show that changing unnamed intermittent streams can fix 98% of the incorrectly classified streams currently in the NHD. USFS found 627 of 22,114 flow lines that were unnamed but determined to be intermittent by the USFS. It is important to note that these changes would not be modified based on the current proposal, because changes based on data-driven edits already made would be retained. Using names to differentiate intermittent from ephemeral streams is a simple process with a surprisingly high level of accuracy, and USGS can make this “wholesale” change directly in the database with minimal disruption. The change involves a simple attribute value update from “intermittent” to “ephemeral.” No geometry is changed and the network remains intact. All features that are modified will be linked to a metadata record describing the process. (It would have no effect on the perennial classification of stream/rivers.) As a screen of all ephemeral and intermittent streams within an area, it can quickly narrow the data set down to a much more manageable number for more refined examination. For example, if USGS had made this proposed change to the Gila NF before USFS made its edits, only 627 features would have to be changed instead of >20,000, allowing users and stewards to focus on the “tricky” areas.

So linking names to intermittent streams in the arid west seems simple, practical and useful. Want to test it for yourself? Select all of the “unnamed” intermittent streams in an area and symbolize them as “ephemeral” and then compare it with your existing data. Let us know what you find.

### **Mapping Indiana’s Streams**

IndianaMap NHD Swipe Map: NHD Swipe Map illustrates the difference between Indiana's original USGS 1:24,000-scale High-Resolution National Hydrography Data Set (NHD), and Indiana's new USGS 1:2,400-scale Local-Resolution NHD. Click on the Vertical line and slide it left-right to expose Indiana's new Local-Resolution streams and ditches.\*\* Click on the Bookmarks 1 - 9 to zoom to US House Congressional Districts. Click on #10 to go back to statewide view. Enter a full address [or a zip code] in the search box in the upper right corner and click on the magnifier to zoom to an address of interest.

\*\*NOTE: Indiana's Local-resolution NHD mapping project is still in progress, so not all areas in Indiana have been mapped. All mapping will be completed by the end of 2015. See:

<http://indianamap.maps.arcgis.com/apps/StorytellingSwipe/index.html?appid=077398328dd8485a9bde427361ee1394>

### **April 2015 Status Report for NHD Network Improvement Project by Cynthia Ritmiller**

#### Initial Phase Network Improvement – Remaining

Region 19 (Alaska) is being completed as part of the Hydrographic Image Update project using the 2012 Horizon Systems QA/QC check results.

#### Initial Network Improvement Regions Completed:

01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, and 22.

## Double Check Phase Network Improvement - Status

- Region 01- Cleaning up the few subbasins which have not passed the QA\QC checks. Most of the work is in sub-regions 0105 and 0108. New pre-staged Sub-Regions were received and QA/QC checks were ran any edits will be completed.
- Region 02 - Completing edits. Sub-region 0203, 0204, and 0208.
- Region 03 - Sub-regions 0308-0318 have been through QAQC checks. Will complete these edits working with our partners schedules.
- Region 04 - Completed edits within this subregion.
- Region 05 - Reviewing sub-regions 0512 and 0514, only a two sub-basins remain.
- Region 06 - These sub-regions will be sent to Horizon Systems for the creation of HiRes Region 07- completed double check phase in May
- Region 08 - Completing double checks within this subregion.
- Region 09 - Completed double check phase in September
- Region 10 - Completing double checks with only a one sub-basin remaining.
- Region 11 - Completing double checks. Sub-region 1101-1111 is finished, only 1112-1114 remains.
- Region 12 - QA/QC checks were completed. This data is almost ready for Horizon Systems for the production of HiRes NHDPlus.
- Region 13 - Completed double check phase in July
- Region 14 - New pre-staged Sub-Regions were received and QA/QC checks were ran. Will complete QA/QC checks.
- Region 15- Once new pre-staged Sub-Regions are received, QA/QC checks will need to be run and then subbasins will be assigned. Region 16 - Completing double checks with only a one sub-basin remaining.
- Region 17 - QA/QC checks have been run and then subbasins will be ready to assign. POC's in
- Region 18 - Completed double check phase in May
- Region 19 (Alaska) - Initial Phase Network Improvement in progress see above.
- Region 20 - Completed double check phase in August
- Region 21 - Completed double check phase in August
- Region 22 (Pacific Islands) - Subregions 2201, 2202 and 2203 were given to Horizon Systems April 1st to begin producing HiRes NHDPlus.

Note: Regions will be edited as per the NHDPlus contract schedule. Before starting a Region the area POC will be contacted.

## **New Member of the USGS Hydrography Staff**

Hello! My name is Chris Helm and I am excited and honored to join the USGS team! I am currently a student at The University of Colorado Denver working towards a Certificate in Geographic Information Systems. I grew up in Kansas and spent many vacations in Colorado as kid. It was during these annual summer treks when I came to realize Colorado was my future home. I received an undergraduate degree in Physical Education from Fort Hays State University. Immediately following graduation I began working in Recreation Management in Kansas City, and after 2 years, followed my heart to the Denver area. For the next 12 years I worked in public parks and recreation as an Athletics Coordinator and Facility & Program Supervisor.

Beginning as a child and continuing through my adult life, I always had an interest in reading and creating maps. So in the Summer of 2014, with the support of my family, I made the decision to pursue a career in GIS; a discipline I had fun with as a hobby. I live in Centennial, Colorado with my lovely wife Michelle, and our two children. I enjoy coaching my son's sports endeavors, hiking, backpacking, cycling, movies and history.

### **The Network Value Added Attribute of the Month**

Do you know your VAA's? This NHD Newsletter article is the fifteenth in a series to describe each of the Network Value Added Attributes. The flow network embedded in the NHD is what gives the NHD its analytic power. The Network VAA's boost this power by pre-calculating a number of network characteristics to make network analysis richer and easier to exploit. This month will examine DnLevel.

Recall that StreamLevel organizes flow networks into a hierarchy. A StreamLevel=1 river will flow into the ocean. For example, the Mississippi River is a StreamLevel=1 river and all NHDFlowlines making up the mainstem of the Mississippi River will be assigned StreamLevel=1. A StreamLevel=2 river will branch off the Level 1 River. For example, the Ohio River is a StreamLevel=2 river. A StreamLevel=3 river will branch off of that. For example, the Tennessee River is a StreamLevel=3 river. The process continues upstream.

DnLevel, or "down level", is the StreamLevel of the mainstem downstream NHDFlowline feature. For example, the NHDFlowline that is the mouth of the Ohio River will be assigned DnLevel=1.

### **NHD Photo of the Month**

This month's photo was taken by Jeff Simley while landing at Centennial Airport in Colorado. See <ftp://nhdftp.usgs.gov/Hydro/Images/LoneTreeIntermittent.JPG>. This is an unnamed intermittent stream at Lone Tree, Colorado, southwest of Denver. In all likelihood this stream may be better classified as an ephemeral stream since it only contains water after snowmelt and thunderstorms. Submit your photo for the NHD Photo of the Month by sending it to [jdsimley@usgs.gov](mailto:jdsimley@usgs.gov).

### **March Hydrography Quiz / New April Quiz**

Kitty Kolb was the first to correctly guess the March NHD quiz as the northwest corner of the big island of Hawaii. See <ftp://nhdftp.usgs.gov/Quiz/Hydrography116.jpg>. Kitty has worked as a Geographer for the USGS North Carolina Water Science Center since 2010. She became intimately acquainted with the NHD while preparing data for the recent North Carolina StreamStats update. Kitty also provides GIS research support to NCWSC projects as varied as studies of coastal groundwater modelling, confined-animal-feeding operations, Albemarle Sound environmental monitoring, and regional rainfall networks. In her previous career, she was an archaeologist.

Others with the correct answer (in order received) were: Gerry Daumiller, Dennis Dempsey, Steve Shivers, Steve Aichele, Kim Jones, Hall Alexander, Clavin Meyer, Stphanie Kula, Marc Weber, Evan Hammer, Matt Rehwald, David Hockman-Wert, Myra McShane, Charley Palmer, Tom Denslinger, Jim Sherwood, Joanna Wood, John Kosovich, Dave Straub, Daniel Button, Alex Pellet, David Szczebak, and Roger Barlow.

This month's hydrography quiz can be found at <ftp://nhdftp.usgs.gov/Quiz/Hydrography117.jpg>. This is an example of medium resolution NHDPlus. It is the headwaters of the water supply for Los Angeles. Where is it? Send your guess to [jdsimley@usgs.gov](mailto:jdsimley@usgs.gov).

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Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Thanks to Kevin McNinch, Ellen Finelli, Greg Matthews, Keven Roth, Cynthia Ritmiller, and Chris Helm.

The NHD Newsletter is published monthly. Get on the mailing list by contacting [jsimley@usgs.gov](mailto:jsimley@usgs.gov).

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Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.